CHAPTER 6. RESULTS OF GEOLOGICAL INVESTIGATION

The lateral ditch investigated in this study was excavated perpendicular to the river channel and extended across most of the floodplain. Floodplain strata exposed in the lateral ditch walls included beds of sandy mud and sandy clay, a paleosol, lenses of sand, and a cobble horizon. Figures 11 through 26 illustrate portions of the lateral ditch wall. Figure 10 serves as a key for the drawings.

Zones 1A and 1B are interpreted as stacked plow zones in muddy sands and sandy muds. The sediment in these plow zones is probably recent alluvium accumulated in part due to erosion since deforestation of the area.

Zones 2 and 3 are distinguished from the overlying sediment by their darker color and apparent increase in humus. Soil samples S-2, S-3, S-4, S-5, and S-6 were collected from Zones 2 and 3. Grain size analyses indicated that the sediment in these zones are a sandy mud (Figure 27). The total organic carbon for samples S-4, S-5, and S-6 ranged from 1.00 percent to 1.61 percent, which is not unusual for organic enriched A-horizons in soils. Zone 3 is interpreted to be a buried A-horizon. It appears that a soil developed on Zone 3 that gave it characteristics of an A-horizon, with an increase in organics and a leaching of clays and iron. Subsequent plowing of the soil worked some of Zone 3 up into Zone 2. The paleosol observed in the lateral ditch (Zone 3) and the plow zone above (Zone 2) were eroded from the ridge crests.

Four sediment samples were collected in and around Feature 17, a pit feature in Zone 3. The grain size distribution was very similar for the initial plow zone (sample S-2 from Zone 2) and the paleosol (sample S-3 from Zone 3), with a slight decrease in percent silt in the plow zone. The sediment sample from within the pit (sample S-1 collected from Feature 17) had a higher percentage of clay than both the adjacent paleosol and overlying plow zone. Sample S-1 collected from the pit feature (Feature 17) contained 1.22 percent total organic carbon. This percentage is similar to the percentage of total organic carbon found in Zones 2 and 3 throughout the lateral ditch. This pit feature did not contain a higher total organic carbon content than the adjacent paleosol and the plow zone above.

Prior to burial of Zones 2 and 3, the surface of the floodplain appears to have had a ridge and swale morphology. These features are fairly common on floodplains (Alexander and Prior 1971; Lautzenheiser et al. 1997) and affect the distribution of sediment during flood events. The ridges and swales are formed parallel to the stream channel, and the ridges could have originally been levees along the channel. Alexander and Prior (1971) found that during flood events the flood water initially enters the swales on the downstream end, gradually rising and inundating the low areas. When the floodwaters breach the levee on the upstream end of the floodplain, flow is reversed and the floodwaters are channeled through the swales to the downstream end of the floodplain. After floodwaters recede, slack water ponds up in the swales. Sediment deposited in the swales tends to be finer grained (clayey) than the sediment deposited on the ridges and the modern levee (Alexander and Prior 1971).

Soil erosion from deforestation and early agricultural land use in the Piedmont resulted in very rapid sedimentation rates altering the normal distribution of floodplain sediment (Costa 1975). Along the Dan River a blanket of recent sediment is draped across the entire floodplain, burying the former ridge and swale morphology. Cultural features were located primarily along the crest of the buried ridges. The layer of sediment deposited over the floodplain since deforestation probably helped to preserve the archaeological sites. Figure 28, an exaggerated

profile of the south wall of the lateral ditch, illustrates the former land surface. Subsoil is seen higher in the profile in areas that formerly had rises.

Zone 4 is interpreted to be overbank deposits formed by suspension settling. This floodplain sediment is the parent material for the paleosol in Zone 3.

Within Zone 4, a horizon of pebble- to boulder-sized clasts was observed in the north wall of the excavation. The occurrence of these large clasts within the fine-grained floodplain sediment indicated an unusual depositional event. During rare cataclysmic rainstorm events, sediment gravity flows can be initiated within drainage basins (Mills and Allison 1995). Sediment gravity flows deposit an admixture of sand, silt, clay and larger clasts. Over time, erosion can sort these deposits, removing the fine-grained sediment and leaving a lag deposit of pebble- to boulder-sized clasts. The horizon of clasts in Zone 4 is interpreted as a lag deposit.

A zone of contorted sand lenses was noted along the north wall in the west end of the lateral ditch. These contorted lenses occurred over a zone about 25 cm in thickness. The contorted structure of these lenses indicates that they are the result of post-depositional deformation of the sediment. These sedimentary structures are interpreted as water escape structures. Water escape structures form when pore water is expelled from a deposit, causing rearrangement of the sediment, deformation of existing laminations, and formation of entirely new structures (Reineck and Singh 1980). Typically, the pore water escapes from a saturated sand bed up into overlying finer grained sediment. As the water escapes upward, sands are carried up through the overlying sediment and deposited in contorted lenses within the overlying deposits.

Conclusions

The depositional history of the floodplain along the Dan River can be reconstructed from the stratigraphy observed in the lateral ditch. The sandy muds and sandy clays (see Figure 27) in Zone 4 were deposited during periodic flooding and normal overbank deposition by suspension settling. The cobble horizon is interpreted to represent a significant flood event that resulted in debris flows depositing a bed of sand, silt, clay, and pebble- to boulder-sized clasts on the floodplain. Subsequent reworking of the debris flow deposit removed the fines, leaving the lag deposit or cobble horizon.

The paleosol in Zone 3 was formed in the floodplain sediment of Zone 4 during a period of lower sedimentation rates. Lower sedimentation rates allow time for pedogenic processes to develop a soil profile. Deforestation of the area and an increase in farming resulted in increased erosion and deposition of up to a meter of silty sand and sandy silts on the floodplain burying, the former ridge and swale morphology, the paleosol (Zone 3), and the archaeological sites.

Sediment within a pit feature (Feature 17) contained a higher percentage of clay than the surrounding paleosol (Zone 3) and overlying plow zone (Zone 2). The percent total organic carbon in the pit feature was similar to the percent total organic carbon in the paleosol and plow zone.